DOE Truck Aerodynamics Project:
A Path Forward

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Project Goal

- **Through the use of a diverse team, we will:**
  - **Help improve fuel economy of Class 8 Truck/Trailers by an unprecedented use of Modeling and Simulation**
    - **We intend to accelerate the use of Computational Fluid Dynamics (CFD) simulation in the Class 8 truck/trailer community in an attempt to:**
      - **better understand fluid mechanics around truck/trailers (and through the gaps!)**
      - **provide a tool for better aerodynamic design and evaluation**

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Approach

- **Invoke Experimental Discovery (USC)**
- **Collect high quality data on simple (then more complex) truck/trailer like shapes (NASA/Ames)**
- **Apply full 3-D RANS computational techniques to validation data in a *very careful approach* to identify deficiencies in current technology (SNL)**
- **Begin implementation of *next-generation*, advanced CFD techniques beyond RANS (LLNL)**
- **Develop new engineering turbulence models and investigate new numerical approaches (Caltech)**
- **Demonstrate new, innovative drag reduction concepts (GA Tech)**

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What's different about this project?

- **Unprecedented use of large-scale computational tools for truck/trailer applications (glimpse of the future)**
- **Fundamental understanding of flow physics**
- **Very careful computations (e.g., grid resolution, etc.) coupled with very careful validation experiments (following established *Guidelines*) from simple to complex geometries**
- **Diverse Team coupled with input from Industry**
  - **–LLNL**
  - **–SNL**
  - **–NASA**
  - **–USC**
  - **–Cal Tech**
  - **–GA Tech**

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The Process to Implement CFD in Truck/Trailer System Design and Evaluation

- **Start simple (numerically and experimentally)**
- **Gain confidence in numerical solutions through established Verification and Validation processes**
- **Numerically: Do what you can now but anticipate future revolutionary advances in computer power (push next generation technology)**
- ***Demonstrate* utility of computational M&S to real people on real trucks**
- **Team with Industry to share "Lessons Learned" and to implement new computational tools**

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The "Vision" for *Path Forward*

Applied Research

11/14/99

Industry

Experimental Validation

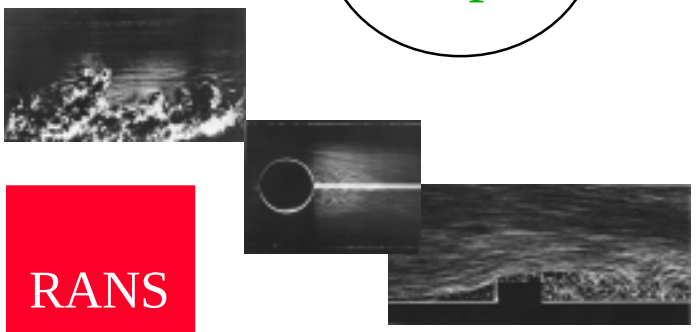
Simple Shapes

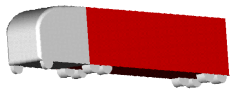
GTS

GTS +

Full Detail Models

Full-Scale Truck Simulation





RANS
LES
DES

Computational Simulations

Careful Validation

Future Efforts

This Project fills a void

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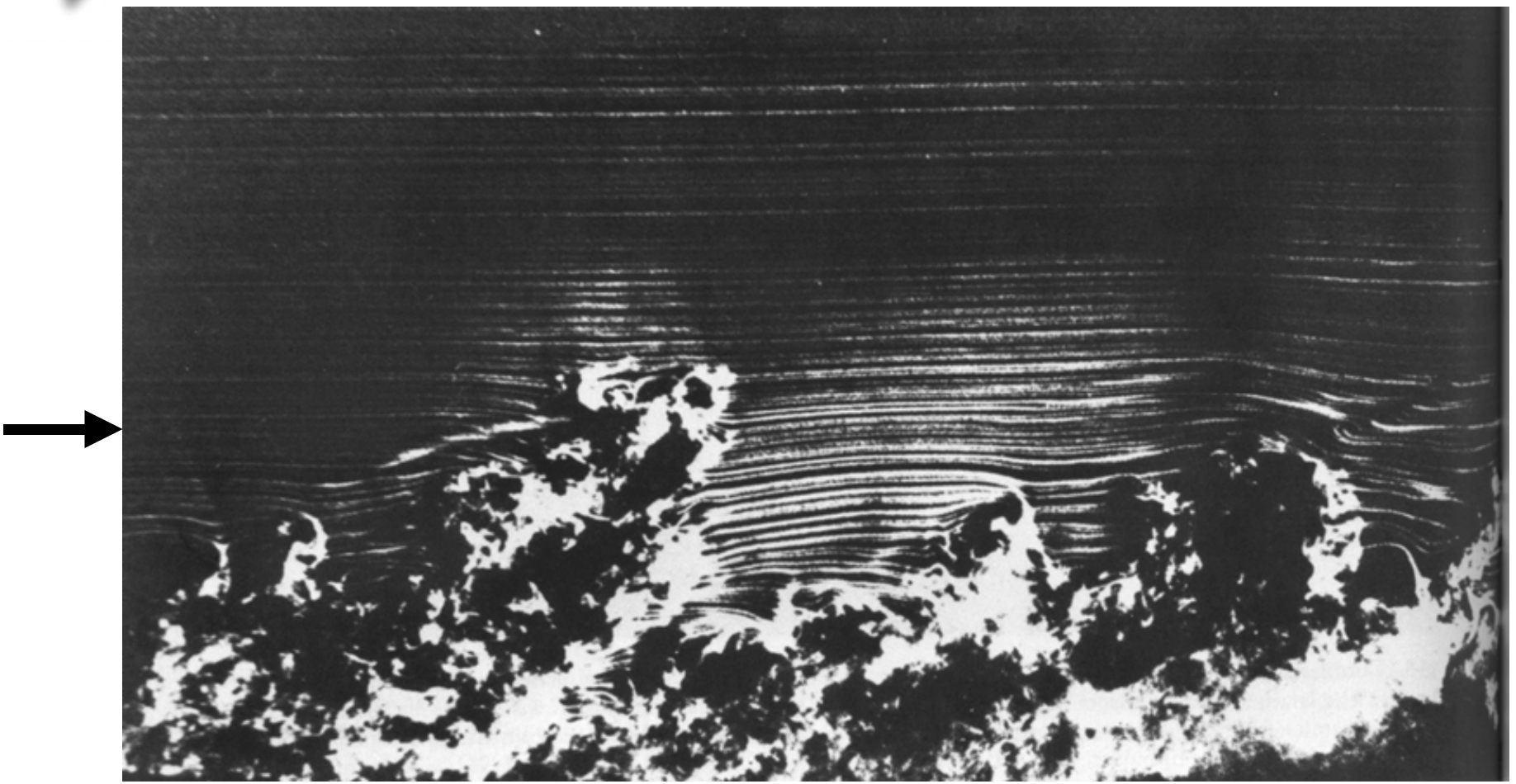

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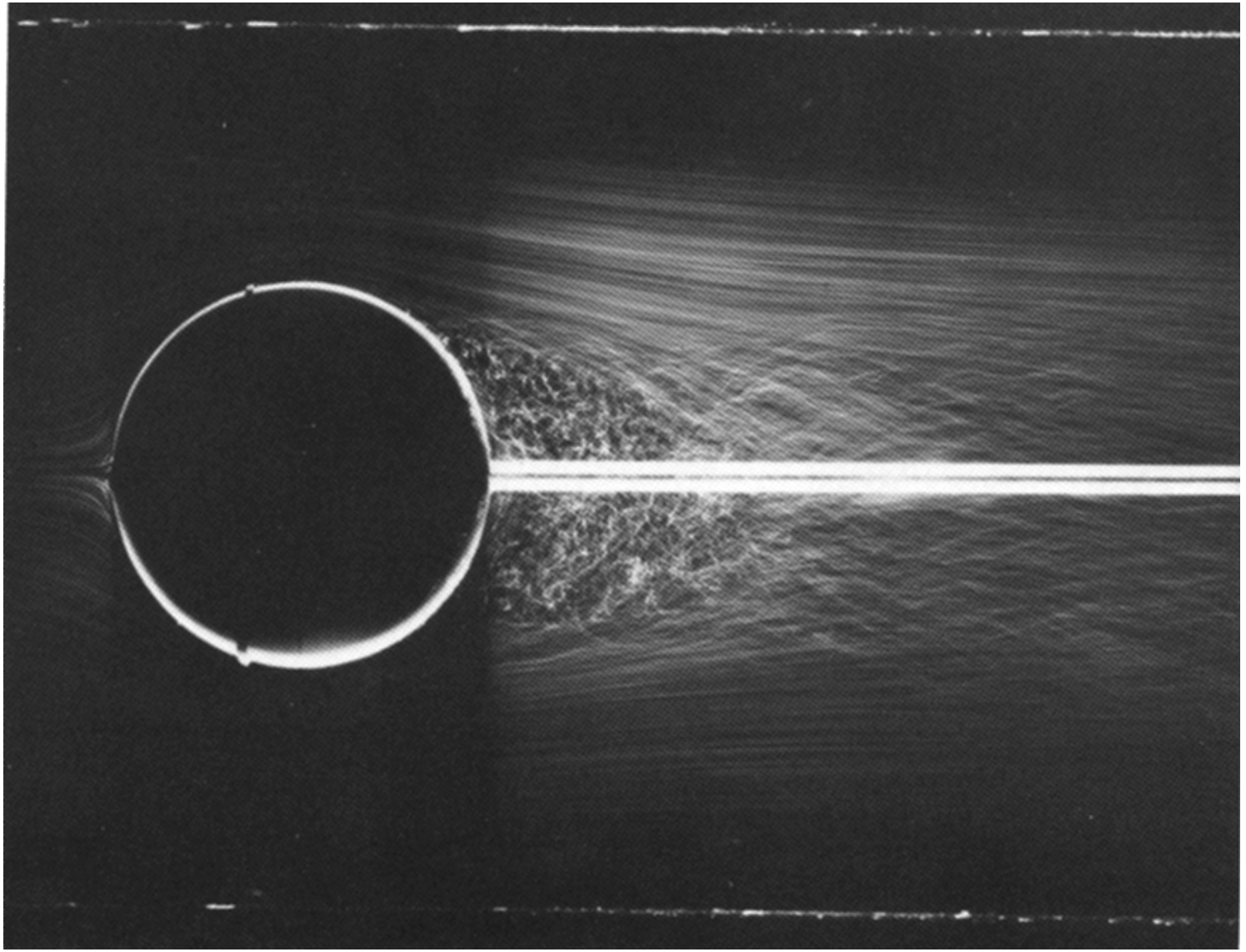

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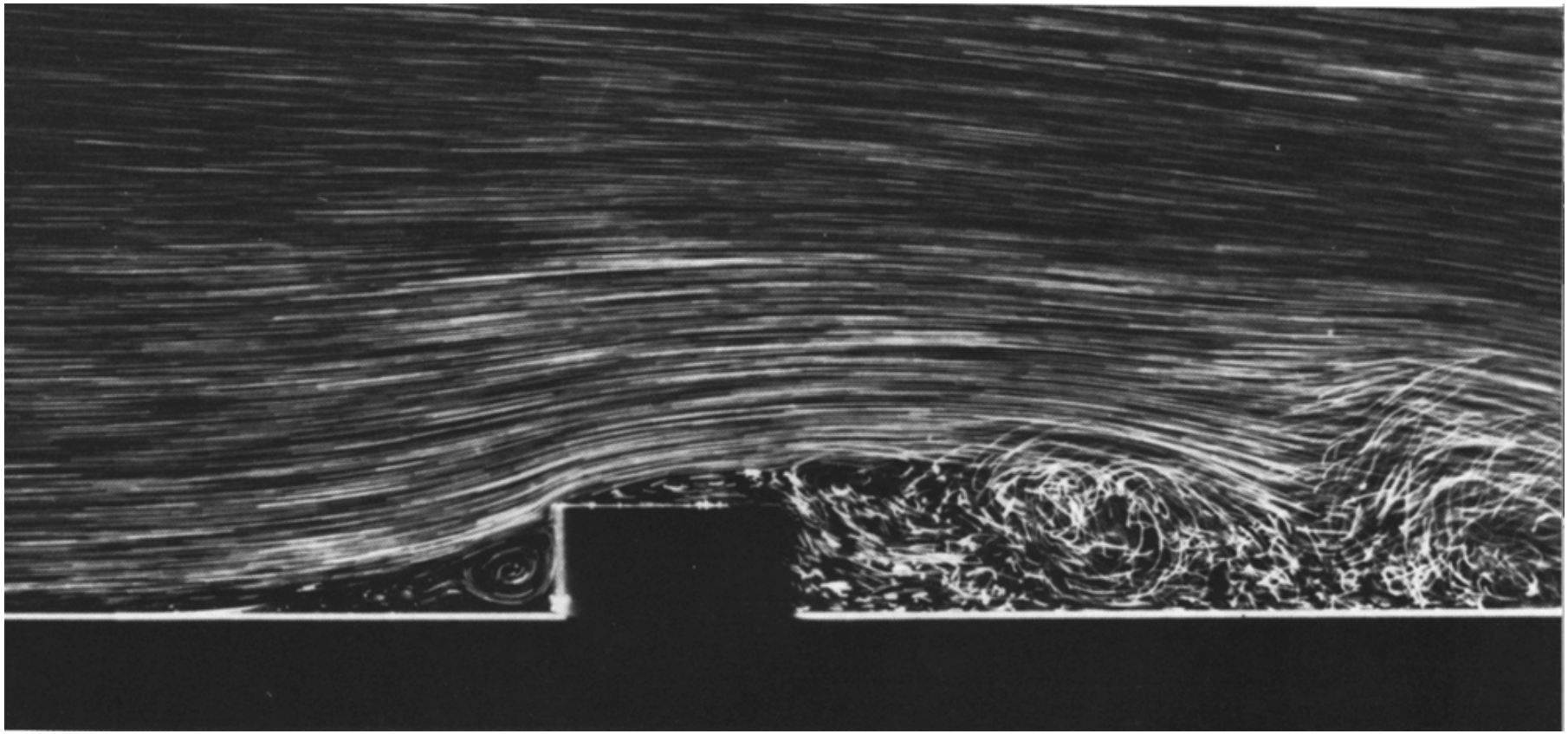

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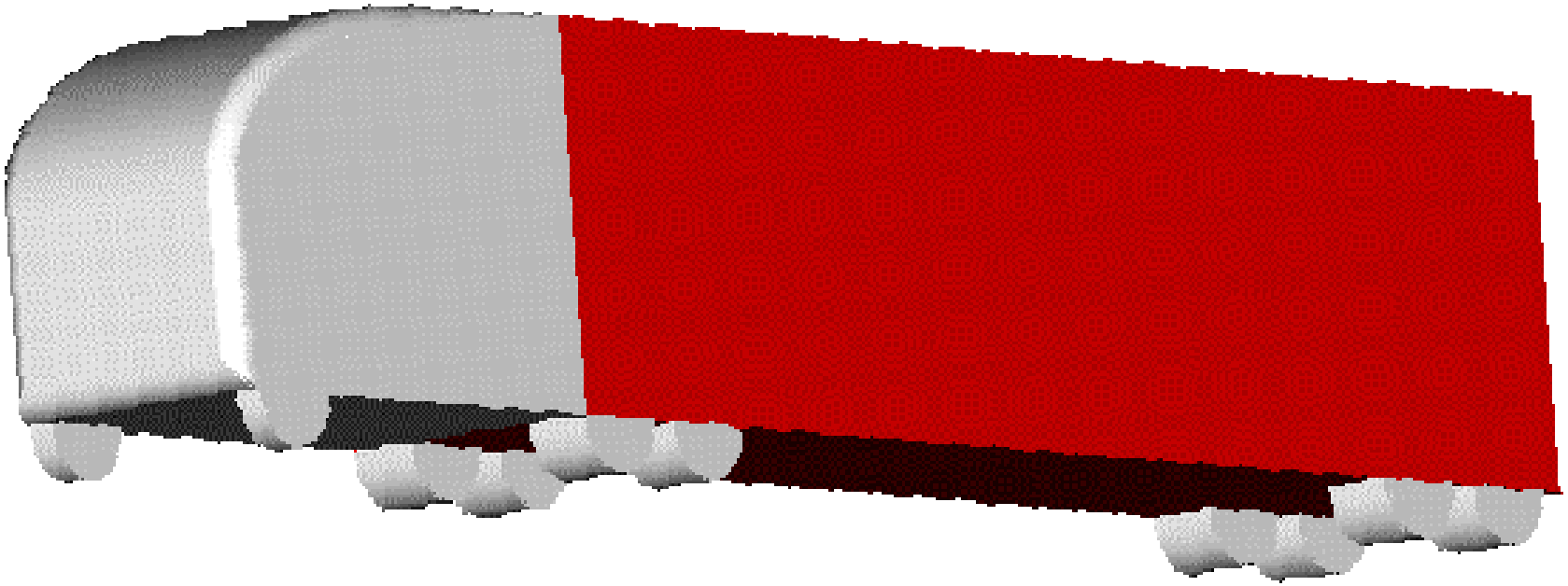

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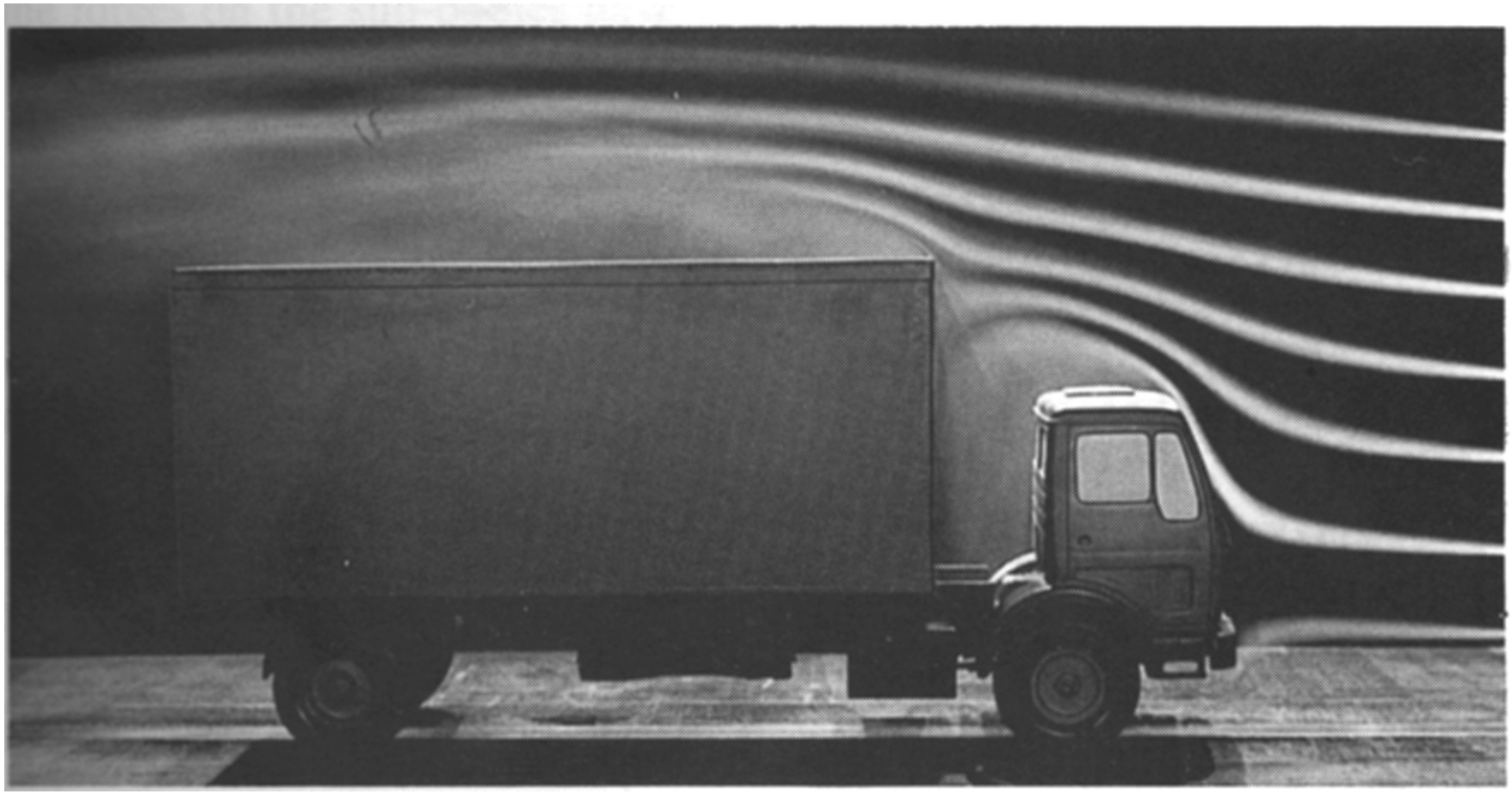

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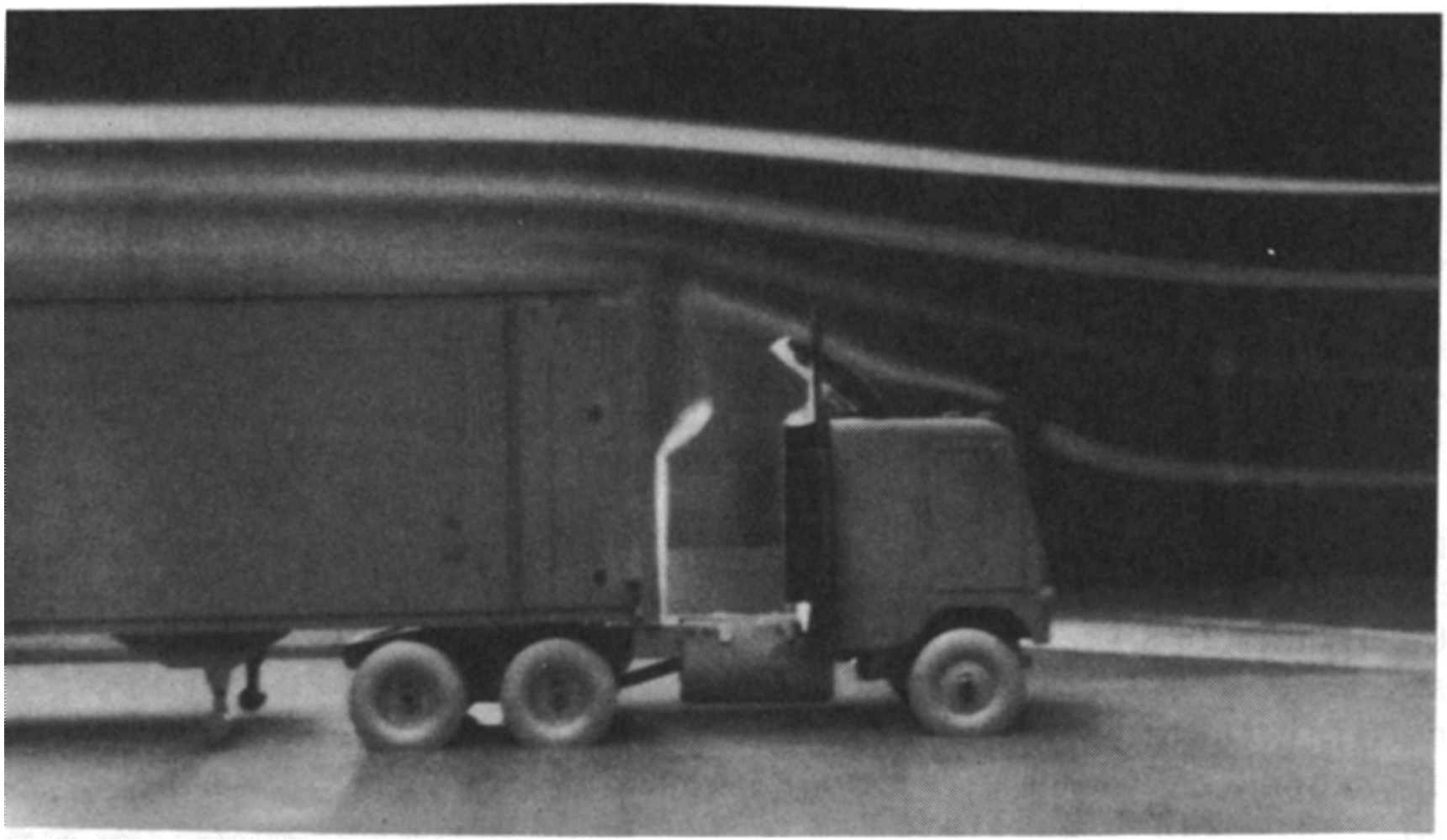

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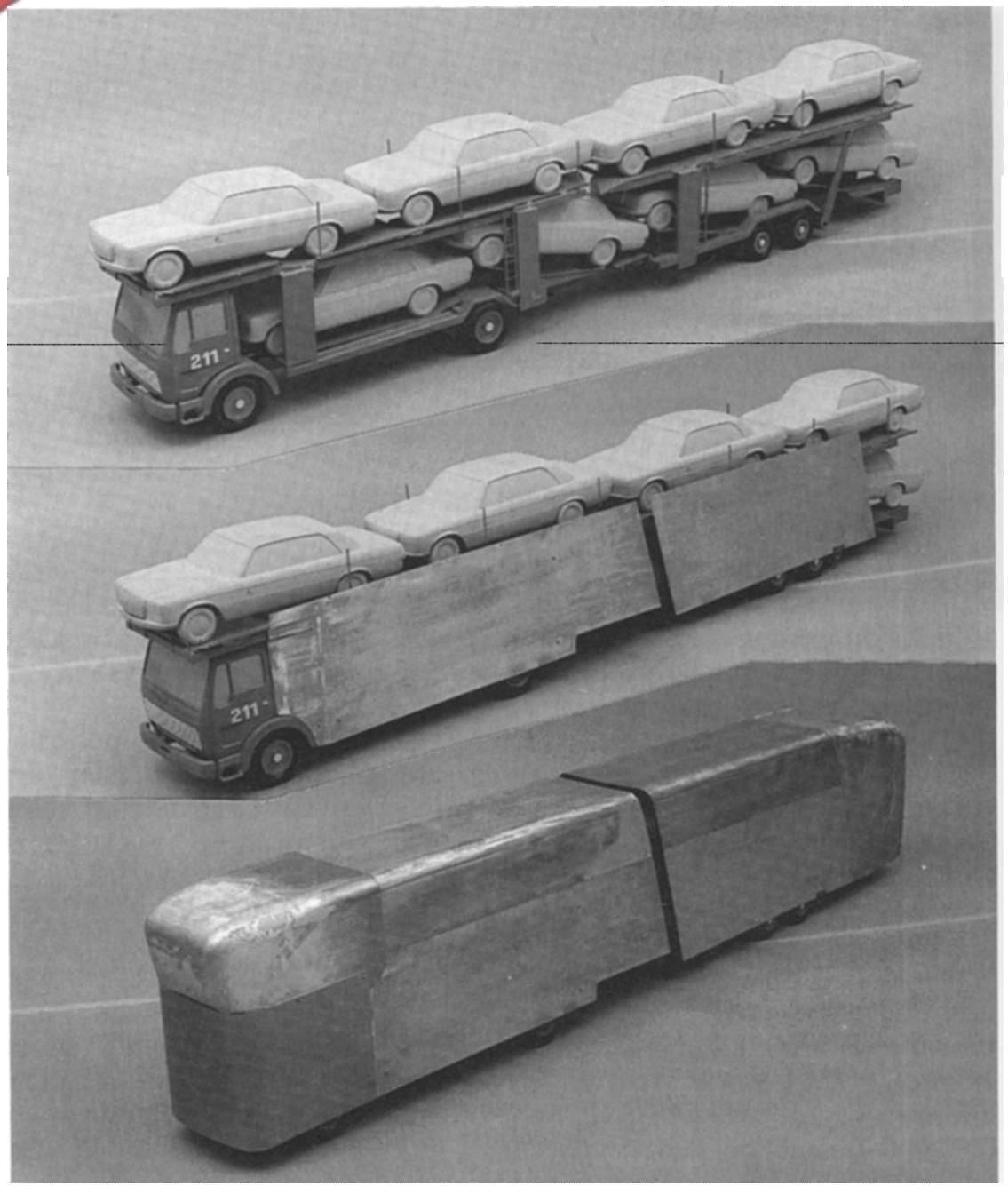

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MID-AMERICA HIGHLIGHTS

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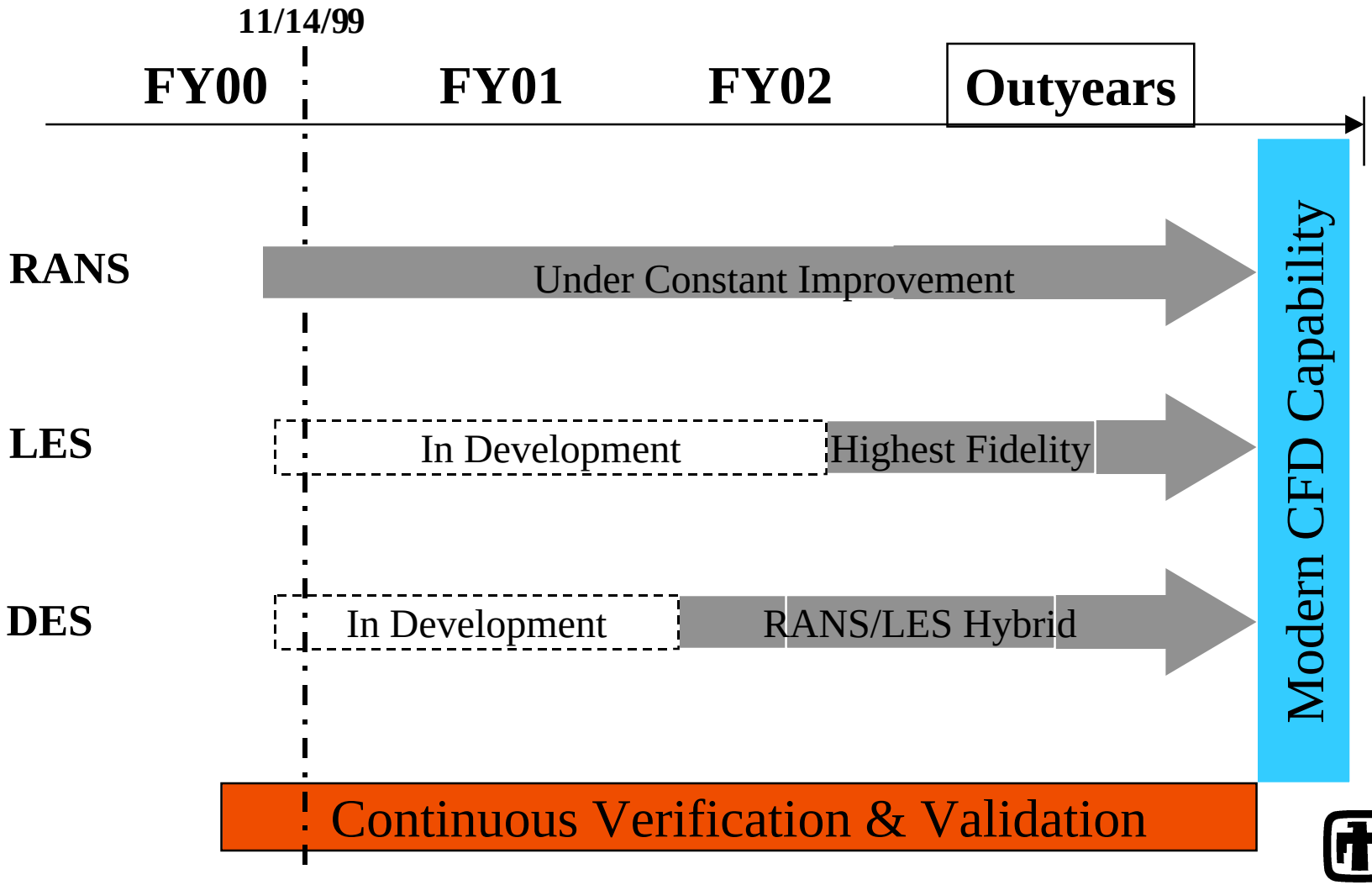
Implementation in Industry



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Conclusion

- **Our Goal is to:**
  - **Advance the use of computational models for truck/trailer design and evaluation in a pervasive way**

This approach will provide industry with a new tool in the quest to design aerodynamically "*smarter*" trucks/trailers and thereby improve fuel efficiency

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